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DAIRY DIVISION, No. 44.

THE WATER CONTENT OF CREAMERY BUTTER.

Since creamery butter—the product of the factory system—has become the leading grade in the markets of this country, a belief has arisen that it ordinarily holds an undue portion of water. And some have thought that the excess of water was increasing in creamery butter, even to the point of intentional “loading” in exceptional cases. When Great Britain and Germany recently established 16 per cent as the legal maximum for water in butter, it was alleged that the American creamery product would generally exceed this standard; and when, under the new law of Congress concerning “renovated butter,” the regulations adopted the 16 per cent limit, manufacturers of this article claimed this to be unfair discrimination, because creamery butter might continue to run beyond this limit, intimating that such large moisture content was usual in the creamery product. No reliable basis existed for such allegations and suggestions, and it seemed desirable to ascertain the facts in this matter.

During the year 1902, the United States Department of Agriculture had opportunities which permitted sampling a large number of packages of creamery butter of known history and direct from the makers. Samples were taken from 730 different packages in all, constituting what may be regarded as a thoroughly representative assortment of creamery butter made in this country. The butter was purchased by the Department for this purpose and other experimental uses. The packages were from 400 different creameries, located in 18 States, and scattered pretty well over the active dairying districts from Maine to California. Nearly half of the butter was made in August, a month when excessive moisture is often feared, and the remainder was produced about equally in the months of May, June, and September. The 800 samples thus taken and submitted to careful chemical tests gave the results shown by the accompanying table.

It is thus seen that the moisture content in the 802 samples examined ranged from 7.2 per cent to 17.6 per cent, with a general average of 11.78 per cent. Butter made in the four months named, considered separately, did not differ much in extremes or in averages. September gave the lowest average of water content and the least range. The averages by months were these: May, 11.81 per cent; June, 11.91 per

cent; August, 11.79 per cent; and September, 11.59 per cent. There were only 3 samples found to contain less than 8 per cent of water, only 1 over 17 per cent, and only 8 over 16 per cent. Nearly seven-eighths of the 802 were between 10 and 14 per cent, and considerably more than half between 11 and 13 per cent.

Summary of water content in samples of creamery butter.

[Eight hundred samples from 400 creameries in 18 States of the United States, taken in 1902.]

Month in which the butter was made.	No. of tubs sampled.	No. of States represented.	No. of samples analyzed.	Water content.			Classification of samples by water content.									
				Highest.	Lowest.	Average.	Below 8 per cent.	8 to 9 per cent.	9 to 10 per cent.	10 to 11 per cent.	11 to 12 per cent.	12 to 13 per cent.	13 to 14 per cent.	14 to 15 per cent.	15 to 16 per cent.	Above 16 per cent.
				Per cent.	Per cent.	Per cent.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
May	122	18	160	16.40	7.20	11.81	1	4	9	25	58	30	22	9	1	1
June	119	18	119	17.62	8.19	11.91	0	4	11	15	35	32	10	5	4	3
August	377	17	377	16.89	7.23	11.79	2	8	25	61	126	86	47	16	2	4
September	112	18	146	15.28	8.30	11.59	0	1	10	23	48	30	26	6	2	0
Totals	730	18	802	17.62	7.20	11.78	3	17	55	124	267	178	105	36	9	8

This is regarded as an unexpectedly good showing for such a large number of typical lots of creamery butter. Great care was taken in the sampling, the treatment of the samples, and the work of making the moisture determinations, with painstaking cross-tests for verification at different points; so that the results are deemed reliable. A considerable number of samples (not shown by the table) were rejected because of accidents and manifest faults, and several records of determinations made were also omitted for like reasons. Yet perfection is not claimed, and if error exists at all it is doubtless in giving figures for water content rather below the actual facts than above them. The samples were all taken from tubs smaller than usual in commerce, holding 20 pounds each instead of 60. It is barely possible that the butter thus packed would lose a little more of its moisture than in larger packages, and yet experimental comparisons fail to support this suggestion. On the whole, this series of trials, the most extensive on record in this country, seems to justify the statements that, during the greatest producing half of the year, American creamery butter has an average water content not exceeding 12 per cent. This fact ought to be satisfactory to producers and reassuring to purchasers and consumers.

Several interesting items have been derived from the records incidental to the work described. All of this butter was examined by an expert judge and scored or marked for quality on a scale of points, about

the time the samples were taken for examination. All packages marked 95 points or over were considered exceptionally fine, and all marked 85 or lower were the poorest lots; although very fair butter. Twenty samples of butter, taken from one tub in each of the four months from the five creameries averaging the highest scores, all above 95 points, had an average water content for the lot of 11.03 per cent; the best of all, 11.53 per cent. These five creameries were in Minnesota and Wisconsin. Five of the poorest lots, taken for comparison, gave an average of 10.6 per cent of water. These were from four other States.

The samples with exceptionally low water content were from butter made in August, May, and June; the highest, in June and August. The very lowest was May butter, and the very highest June butter.

In the September butter the scorer, an experienced and most competent judge, marked eight tubs as showing too much moisture (commercially). Samples from these averaged 12.67 per cent of water. Two packages marked "full of water" had 10.77 and 11.45 per cent (average 11.11), and two marked "worked too dry" had 11.25 and 13.30 per cent (average 12.27). These results show the impossibility of forming an accurate opinion as to actual water content of butter from its appearance alone, even when closely examined by a keen observer.

By way of comparison, the following data are quoted as among the most reliable which are available:

Canadian butter: During the months of July and August, 1902, officials of the Canadian Department of Agriculture collected samples from 105 lots of creamery butter, representing the product of five different Provinces of the Dominion. The water content of these was determined with the following results: Minimum, 7.94 per cent; maximum, 16.77 per cent; average of 105 samples, 12.31 per cent. These were classified thus:

Between 7 and 8 per cent	1 lot.
Between 8 and 9 per cent	1 lot.
Between 9 and 10 per cent	4 lots.
Between 10 and 11 per cent	15 lots.
Between 11 and 12 per cent	24 lots.
Between 12 and 13 per cent	23 lots.
Between 13 and 14 per cent	24 lots.
Between 14 and 15 per cent	10 lots.
Between 15 and 16 per cent	2 lots.
Between 16 and 17 per cent	1 lot.
Total lots	105

Danish butter (from official reports of butter on the English markets): 2,001 summer samples, 14.03 per cent; 1,930 winter samples, 14.41 per cent; average of 8,314 samples, 13.97 per cent of water.

Swedish creameries: 8,340 samples; 13.57 per cent of water.

American creamery butter (selected from experimental exports by

United States Department of Agriculture, 1897-99): 64 samples, average 11.03 per cent.

All countries (B. Martiny): 17,332 samples, average 13.55 per cent of water.

The inquiry into the water content of creamery butter, as above described, was conducted during the year 1902 under the supervision of the Dairy Division, Bureau of Animal Industry. The analytical work was mainly done by the Dairy Laboratory of the Bureau of Chemistry.

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Approved:

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